SCIENTIFIC ARTICLE

The Carpometacarpal Stress View Radiograph in the Evaluation of Trapeziometacarpal Joint Laxity

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Purpose Hypermobility at the thumb carpometacarpal (CMC) joint has been proposed as an explanation for abnormal loading and subsequent development of osteoarthritis. Radiographic evaluation of this joint is difficult owing to the obliquity of the articulation. We modified a previously described technique to obtain a bilateral stress radiograph of the thumbs to measure CMC joint laxity. The purpose of this study was to present the details of this modified technique and evaluate its reproducibility in a group of volunteer subjects. We hypothesized that this technique would be reliable and reproducible.

Methods A posteroanterior radiograph was obtained after asking volunteer subjects to press their thumbs together using a foam hand support. Three measurements were performed: radial subluxation of the first metacarpal base, first metacarpal articular width, and the distance between the ulnar articular facet of the trapezium and the ulnar metacarpal edge (uncovered edge). Using digital calibration on a picture archiving and communication system radiology server, a radiologist, radiology resident, orthopedic surgeon, and orthopedic resident performed measurements at 2 time points. To evaluate consistency among the raters, intraclass correlation coefficients were calculated. Test–retest bivariate analyses were performed to assess intra-rater reliability.

Results A total of 69 volunteers (39 women and 30 men) were imaged. Women showed significantly greater radial subluxation compared to men ($p < .01$). Inter-rater reliability coefficients for radial subluxation and articular width initially and at 2 weeks showed high agreement, as did test-retest reliability coefficients. For the uncovered edge measurement, inter-rater reliability coefficients were low, with wide variation in reliability.

Conclusions The modified thumb CMC stress view radiograph evaluates laxity and joint abnormalities of the trapeziometacarpal articulation. The details of the radiographic technique are straightforward, and the inter- and intra-observer reliability of radial subluxation and first metacarpal width are high. The ratio of the 2 measurements provides an accurate measure of the radiographic subluxation of the first metacarpal from the trapezium. This measurement is most specific to radial subluxation under simulated active loading, in the plane of the hand. The medial uncovered edge of trapezium measurement does not have high inter-observer reliability and varies widely, and it should not be included in laxity measurements. *(J Hand Surg 2009;34A:1402–1406. © 2009 Published by Elsevier Inc. on behalf of the American Society for Surgery of the Hand.)*

Key words Laxity, carpometacarpal, stress view radiograph.

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Hypermobility of the thumb carpometacarpal (CMC) joint is one of several theories proposed for the etiology of thumb CMC arthritis. Jonsson et al. noted a higher prevalence of generalized joint hypermobility (as scored by the standardized Beighton criteria[1]) in patients with osteoarthritis (OA) of the thumb CMC joint when compared to a control group without OA.[2,3] In a study of 24 patients with Ehlers-Danlos disease, a collagen-vascular disorder characterized by joint hyperlaxity, two-thirds had trapezial-metacarpal (TM) subluxation, and 16% had OA, at an average age of 16 years.[4] These studies support the theory that abnormal loading of a hypermobile joint causes stress, with later cartilage breakdown leading to OA.

The radiographic evaluation of the patient presenting with thumb CMC joint pain can be challenging because of the obliquity of the orientation of the joint in both the coronal and sagittal planes.[5] In addition, the saddle shape of this joint, which allows a wide degree of motion, makes imaging difficult with plain radiography.[6] The standard 3 views of the thumb or hand, which include posteroanterior (PA), oblique, and lateral views, tend to show substantial overlap of the trapezium and trapezoid as well as the first and second metacarpals.

The Bett's or Gedda's view, described in 1954 for imaging the base of the first metacarpal in Bennett's fractures, was characterized by the authors as a true lateral of the TM joint, perpendicular to the plane of the hand. This is performed as a posteroanterior view, with the hand pronated 30° and the axis of the imaging tube angled 25° distally.[7] This radiographic image isolates the TM joint and minimizes the overlap seen in other views, but it does not reliably image through the joint. Dela Rosa et al. evaluated the interobserver and intraobserver reliability of PA, lateral, and Gedda's view combination, and they showed only moderate interobserver agreement on rating the stage of OA.[5]

The stress view radiograph of the CMC joint was originally described in Eaton and Littler's article that described their technique and results for ligament reconstruction for the painful CMC joint. The authors noted that it gave "a valuable index of the degree of capsule laxity."[8] This paper stated that the radiographic view is "an anteroposterior view of bilateral thumbs with radial margins pressed together."[8] Tomaino et al. had a similar description but noted that the "radial margins of the distal phalanx" were pressed together.[9] Clancey's technical note states in a figure legend that the stress view is "taken in the PA projection."[10]

FIGURE 1: Stress view configuration, with the subject's thumbs pressed together with the nails parallel.

To our knowledge there has been to date no detailed description of the technique, nor quantitative analysis of the stress view to evaluate joint laxity or arthritic change. We present our technique, as modified from the original description of Eaton and Littler, for the CMC stress view radiograph as an analysis of joint mobility, specifically radial subluxation of the first metacarpal under simulated active loading with specified contact positioning of the thumbs and hands. We evaluated the reliability and reproducibility of multiple radiographic measurements of joint alignment, using a large series of radiographs from volunteers. We hypothesized that this modified technique would result in an accurate and reproducible measurement of CMC joint laxity.

MATERIALS AND METHODS

Technique

Based on the figures in the articles by Eaton and Littler, and others,[8–10] we deduced that the view is taken in the PA projection with the hand and stress view of the TM joint placed over an X-ray cassette (the volar aspect of the hand touching the cassette), with the forearms held about 10 cm apart and pronated approximately 45° in neutral deviation. The subject is instructed to place the thumbs parallel (nails symmetric without tilt) and to actively press them together with the metacarpophalangeal (MCP) and interphalangeal joints touching. The MCP joint is held in slight flexion at 15° to 20° and the interphalangeal joint is positioned at 0° extension (Fig. 1). The wrists are held in neutral alignment and the elbows flexed to 90° bilaterally with the subject seated.

We then performed several pilot fluoroscopic views and, based on photographs, fashioned a foam support